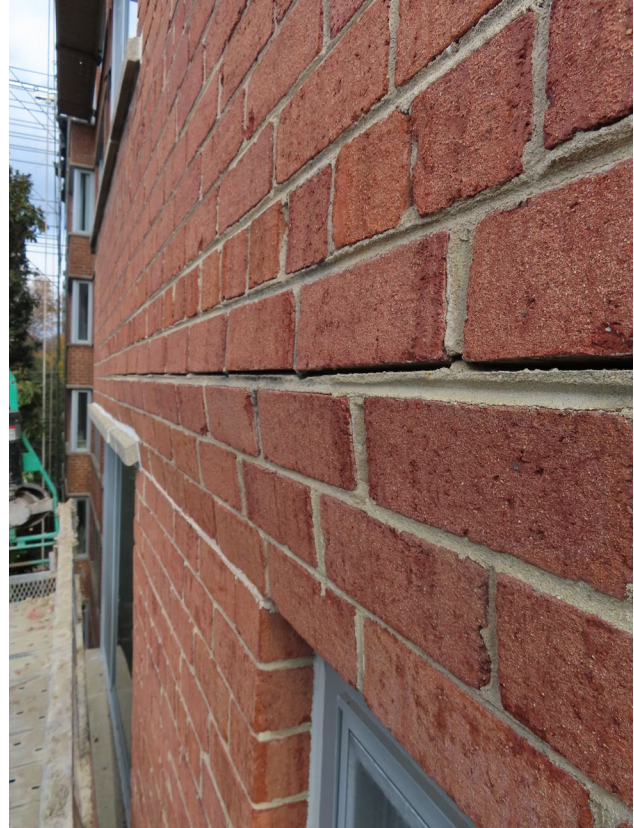


Cathedral Avenue Condominium Forensic Investigation, Design Repairs & Quality Assurance During Repairs



Unstable Parapet



Masonry Lifting and Cracking After Tuckpointing



Accent Double Corbel Parapet for Clearance



1998 Resto, Superficial Expansion Joints 2" into 4" Brick

The Cathedral Avenue condominium is an eleven-story building constructed in 1954, situated near American University in Northwest Washington, DC. The structure consists of a conventional reinforced frame and 8' thick masonry exterior walls comprised of 4" brick and 4" cinder block substrate. The standard practice for construction of tall concrete frame structures around this era has an inherent deficiency causing vertical stress to build up in the masonry, resulting in the brick façade bulging outwards at the supports in front of the floor slab. This usually did not manifest until 10-15 years after the construction is completed.

Challenge – Masonry Exterior Walls

- Defective Remedial Design: The movement in the masonry at the bulges formed cracks in the mortar horizontal joints resulting in water infiltration. A full façade restoration project was performed in 1998. The remedial design was deficient by not including a solution for eliminating the vertical stress. Instead, mortar joints were tuckpointed in an attempt to prevent water infiltration through the existing cracks. This tuckpointing reintroduced the vertical stress, which increased the cracking at the masonry. See top right photo.
- Defective Remedial Workmanship: The 1998 program included installing vertical expansion joints to relieve horizontal stress. During D&A’s analysis, stress crack patterns consistent with horizontal stress was documented. Further investigation, including borescope analysis, revealed at all locations tested, that the vertical expansion joints – which must be cut through the full 4” depth of the brick – were superficial and only extended up to 2” into the brickwork, which does not relieve any of the stress. This is consistent with the work being performed much cheaper with a lightweight grinder instead of the more suitable and substantial masonry saw.
- The 1998 program **did not confirm the as-built conditions, and therefore ignored the vertical stress deficiency**. Between 2010 and 2019, a forensic engineering firm investigated the bulges at the slab edges and concluded that the cause was the defective masonry support design typical in the 1950’s and 1960’s. **A remedial program was designed without ever substantiating the actual as-built conditions.**

Value Added – Masonry Exterior Walls

D&A was retained in 2019 to provide a peer review of a new proposed remedial program.

- D&A 45 Year Forensic Experience Advantage: The analysis commenced with visual observations to map the bulge patterns around the perimeter of the building. For cost efficiency, this scope was limited to the lowest two stories and was achieved using ladders. During the initial phase of the analysis, D&A identified that in most locations, the masonry was lifting up and outward while remaining plumb. This is inconsistent with the even bulge manifestation of the common 1950’s and 1960’s deficiency and therefore the corresponding typical repair would not be advised.
- In-House Borescope Testing Advantage: D&A’s equipment is more technically advanced than most forensic firms.
 - With a controlled, articulating tip and extended visual range, this camera can be guided around obstacles in the masonry cavity to confirm the actual design of the masonry support at the slabs and document the extent of movement off of the slab support.
 - The Borescopic analysis was then expanded to substantiate the concealed conditions at a cross-sample of floors and elevations. This was accomplished with access through windows to drill a ¼” hole in mortar joints. This avoided the disruption and high cost of typical masonry probes, which require installing a swing stage in order to remove several square foot sections of brickwork for each test location.
- Change Masonry Wall Assembly Type Greatly Reducing Remedial Cost: The masonry walls were originally designed as “barrier wall construction.” This relies on solid masonry to prevent water from passing through the outer brick wythe in order to prevent leaks. Unfortunately, the workmanship of the original construction was poor and resulted with water infiltration through the voids in the mortar joints and collar joint. The scope of the 1998 façade restoration project included full tuckpointing. The workmanship of this was poor or improper, diminishing its effectiveness. This is compounded by the masonry re-cracking from the stress of the original design deficiency remaining after the vertical expansion joints were only superficial. The D&A remedial design includes steel angle masonry supports at the slab edges, and the flashing and weepholes which are typically included to protect the steel installations. Borescopic analysis confirmed that the grout fill in the collar joint had been omitted, forming a continuous void. There is also a black membrane on the top slab that extends under the block and only the back half of the brick, allowing any water infiltration to drain into the floor level below. The design of the new flashing system is extended up the full height of the slab and the full depth of the brick to be tied into the membrane. This modification changes the defective “barrier wall assembly” into a properly functioning “drainage cavity assembly”. This eliminates the need to redo the tuckpointing, **at a savings of over \$3.8M.**

Service Performed:

- Forensic Investigation, Construction Analysis and Construction Forensics, Waterproofing investigation
- Design revised parapet replacement, facade repairs including flashing details
- Quality Assurance - Construction Phase Services

Owner/Client: Cathedral Avenue

Architect: Davidson and Associates (D&A)

Contractor: Masonry Preservation Services (MPS)